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Plant culture: thirteen seasonal pieces

February – constructing a corymb

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According to Robert Graves' mythological interpretation of the seasonal cycle, February is associated with the rowan tree. Corymb is the systematic name for the rowan inflorescence that produces the distinctive group of orange berries. The corymb, a gently domed cluster, is related to a panicle and an anthela, differing from them in the extent of upgrowth of the inflorescence branches. Soon, molecular biology will provide a gene-driven description of each inflorescence structure. This advance illustrates the progress of science: previous issues of inflorescence classification are not resolved, but a new system, reflecting the availability of new technology, is established. The artist and poet William Blake remarked that it is better to invent a system, than be enslaved by that of another. He also railed against science for its improper restriction to the imagination.

February is the month of the rowan tree. *Sorbus aucuparia*, tree of quickening, mountain ash or rowan, bears its flowers in a gently domed cluster or corymb. Each flower when fertilized ripens to a bright orange berry. The corymbs of berries decorate the tree so it can easily be seen from a distance, often solitary on a hillside. Here I look briefly at some different ways to construct a corymb, emphasizing, with William Blake (1757–1827), the egotistical dimension to the activities of scientists.

Fig. 1. (a) The rowan corymb. (b) Self-similarity within the corymb. (c) A panicle as generated by the model of Prusinkiewicz and Lindenmayer (1990). (Drawings courtesy of Steven Appleby.)

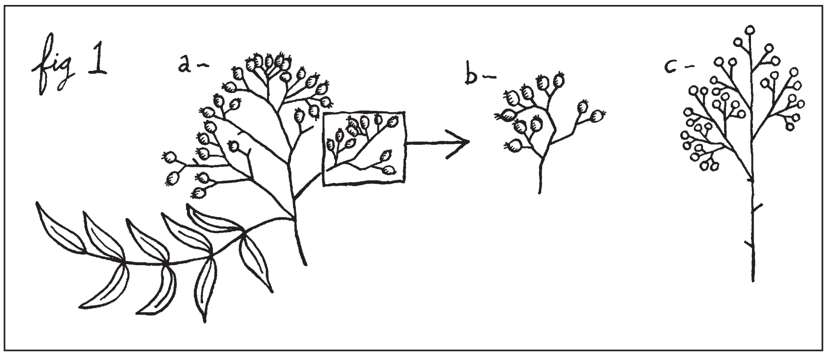

Figure 1a is a drawing of a rowan corymb. Like a fractal pattern, any one part seems related to the whole (Fig. 1b). The branching of a panicle, closely related to the corymb, has been reproduced mathematically, and the key equation simulates the presence of two continuing growing points at each node (Fig. 1c). Although a real panicle or corymb is less regular, the rowan inflorescence shows sufficient regularity for a squinting eye to see the self-similarity that results from this mode of growth. Music with the same eerie sense of unfolding repetition through variation is known as Fractal or Mandelbrot Music, and can be heard at www.fin.ne.jp/~yokubota/mandele.shtml.

A corymb differs from a panicle only in the extent of upgrowth of the inflorescence branches. In a panicle, the degree of branching increases down the inflorescence to give a conical outline. In the corymb all the flowers are elevated so that they lie at about the same height, giving the gently domed shape. A further elongation of the lateral axes results in their overtopping the parent axis, giving a goblet-shaped inflorescence known as an anthela, and found in meadow-sweet (*Filipendula ulmaria*). This series of shapes is illustrated in Fig. 2.

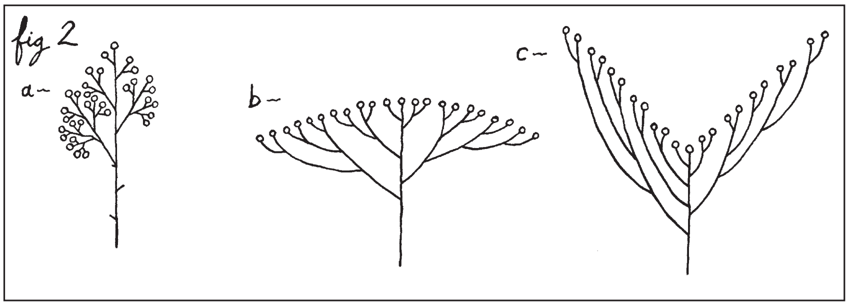

Fig. 2. (a) Panicle. (b) Corymb. (c) Anthela. (Drawings courtesy of Steven Appleby.)

How is the branching pattern generated and extended to give the gently domed shape? Every axis terminates in a flower, so this character on its own is not significant. But the duration of branch growth must be crucial. Some evidence comes from studies of grasses that produce paniculate inflorescences. In the *indeterminate spikelet1* maize mutant, the spikelet meristem produces additional lateral flowers because its growth remains active (indeterminate) rather than becoming determinate. In the *indeterminate floral apex1* mutant a similar effect extends to all the meristems of the inflorescence. Conversely, in rice *lax1*, the fate of the rachis branch meristem is altered so that indeterminate growth cannot continue. This suggests that the corresponding genes control branching pattern by suppressing, or enforcing, indeterminacy of meristem growth at the appropriate time.

Growth termination therefore seems central to inflorescence architecture, in particular inflorescences like the corymb. This appropriately connects rowan to February, because February is the month of termination in the original Roman calendar. The Terminalia was celebrated on February 23, in honour of the god Terminus, associated with boundaries. The Terminalia followed the festivals of purification and atonement from which the month takes its name; *februum* means an instrument of purification. Molecular biology has proved a *februum* for understanding inflorescence branching patterns. It steps around the issues that concerned generations of inflorescence analysts, who got bogged down in the attempt to find a consistent system of classification based on theory: cymose or racemose, monopodial or sympodial, determinate or indeterminate. None of these systems works properly, despite much toil. Experimentally determined facts, expressed in terms of gene function and interaction, seem greatly preferable. But the molecular identification of genes that are needed for processes (here inflorescence branching) is itself becoming a new system. This tendency to system-building was summarized by the great individualist William Blake:

> ‘I must Create a System, or be enslav’d by another Man’s
> I will not Reason and Compare: my business is to Create’

We each, busily, build systems which the facts of nature are used to support. For each generation of scientists, one system dominates and creates an idea of objective certainty. Blake considered the whole of science, represented by Bacon, Locke and particularly Newton (Fig. 3), dangerous because it was an improper restriction to the imagination, a 'Satanic' parody of imaginative vision. Many people are hesitant about the achievements and future directions of science and technology. Perhaps they want scientists to acknowledge that Blake had a point, even though it was overstated.

Fig. 3. Newton (William Blake, 1795: Tate Gallery, London). According to Raine (1970), this picture 'shows the "spiritual state" of the great scientist; he is absorbed in mathematical calculations, his eyes fixed on the diagrams he draws on the bottom of that "sea of time and space" which is the principle to which he is confined'.

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